Unit 7 Day 4 p99-100: 16-26 all

(16) <u>Step 1</u>

Convert 26 miles to meters

1 meter = 3.281 ft

1 mile = 5280 ft

marathon → feet

$26 \cancel{mi} \cdot \frac{5280 ft}{\cancel{mi}} = 137{,}280 ft$ in a marathon

feet → meters

$137{,}280 \cancel{ft} \cdot \frac{1 m}{3.281 \cancel{ft}} = 41840.90_m$ in a marathon

<u>Step 2</u>

How many 100 m dashes are there in a marathon

$\frac{41840.90}{100} = 418.4$ 100m in a marathon

<u>Step 3</u>

100 m dash time X # of 100 m in a marathon

9.84_{secs} X 418.4 =

4117.056 secs for the marathon

<u>Step 4</u>

Convert to hours / mins

$\boxed{1 hr\ 8 min\ 37 secs}$

$4117.05 sec \cdot \frac{1 min}{60 sec} \cdot \frac{1 hr}{6 min} = 1.1436$ hours

<u>Step 5</u>

Convert decimal to min .1436 · 60 min = 8.61

<u>Step 6</u>

Convert .61 to sec

.61 x 60 = 37 sec

Unit 7 Day 4 Continued

17

	(mph) Rate	(hour) Time	Distance D=rt
Car	$r+4.5$	$\frac{1}{3}$ min	$\frac{1}{3}(r+4.5)$
Bike	r	$\frac{3}{4}$ min	$\frac{3}{4}r$

I will use a chart to represent each of the distances in terms of r (rate). Then, I will set those expressions equal to one another because the distance from work to work is the same, no matter how he travels.

let r = rate

Distance in car = Distance on Bike

$$\left[\frac{1}{3}(r+4.5) = \frac{3}{4}r\right]12$$

$$4(r+4.5) = 9r$$

$$4r+18 = 9r$$

$$18 = 5r$$

$$\frac{18}{5} = r$$

$$= d$$

Now, to find the distance, substitute r back in either $\frac{1}{3}(r+4.5)$ or $\frac{3}{4}r$

$$\frac{\cancel{18}^{9}}{5} \cdot \frac{3}{\cancel{4}_{2}} = \frac{27}{10} = 2.7 \text{ miles}$$

Unit 4 Day 4

(18)

	rate (mph) r	time (hours) t	distance (miles) d=rt
To	50	t	50t
From	40	t+.25	40(t+.25)

We need to find the distance travelled. We know that the distance travelled to the appt. is the same as the distance travelled from the appointment. Therefore, when we express the "distance to" and the "distance from" in terms of the same variable (t), then we can equate those expressions. We then have an equation that we can solve for t.

let t = time travelled to work (hours)

∴ "To" time = t

"From" time = t+.25

"To distance" = "From distance"

$50t = 40(t+.25)$

$50t = 40t + 10$

$10t = 10$

$t = 1$

Since t=1, It took her 1 hour to travel <u>to</u> work and 1 1/4 hours to travel from work. When you substitute 1 in for t in either distance expression (50t <u>or</u> 40(t+.25)) you find that d = 50 miles.

$d = 50t = 50(1) = 50$ miles

<u>or</u> $d = 40(t+.25) = 40(1.25) = 50$ miles

The distance to the appt. is 50 miles.

Unit 7 Day 4 Continued

(19) Important: Expressing the time travelled in this problem is a little more difficult. We are not explicitly told how much longer or shorter the time travelled was for one leg of the trip. Instead, we are told that they total to 32 hrs. Therefore, you must use a variable for the time travelled (t) to or from. Express the other time travelled as 32 − t. Once we solve for t, we use either expression for distance to get the distance.

	r (mph) rate	× t (hours) time	D (miles) Distance
To	50	t	50 t
From	55	32-t	55 (32-t)

let t = time travelled to D (h)

Dist. travelled "to" = Dist. travelled "from"

$$50t = 55(32-t)$$
$$50t = 1760 - 55t$$
$$105t = 1760$$
$$t = 16.76190$$

$$\text{Distance} = 50(16.76)$$
$$= 838$$

The distance between the two cities is about 840 miles.

(20)

	Rate (Km/hr)	$t=\frac{D}{r}$ time (hours)	Distance Km
Plane	x	$\frac{420}{x}$	420 Km
Car	40	$\frac{20}{40}=\frac{1}{2}$	20 Km

let x = rate of the plane

Time travelled by plane = time travelled by car $+ \frac{1}{4}$ hr

$$\frac{420}{x} = \frac{1}{2} + \frac{1}{4}$$

$$\frac{420}{x} = \frac{3}{4}$$

$$3x = 1680$$

$$x = 560$$

The plane travelled 560 ~~K~~ph.

The plane and the car do not travel the same distance. Therefore, we can not equate them like we have in past problems. Start by assigning a variable for what you are ask to find - the rate of the plane. Then, we can set up an equation that relates the time travelled (car left ¼ h after plane). First, each time must be expressed using the relationship that $t = \frac{D}{r}$

(21)

	r Rate (mph)	$\times$ t Time (hour)	$=$ D Distance (miles)
Russ	7	x	$7x$
Janet	5	x	$5x$

Let x = time elapsed in race

Russ's distance = Janet's dist + $\frac{1}{2}$ mile

$$7x = 5x + \frac{1}{2}$$

$$2x = \frac{1}{2}$$

$$x = \frac{1}{4}$$

It will take $\frac{1}{4}$ hr or 15 mins for Russ and Janet to be $\frac{1}{2}$ a mile apart.

Note The fact that the race is the same distance is irrelevant. We are only concerned with the point in the race when they are $\frac{1}{2}$ a mile apart. Set a variable for what you are asked to find and express the distance in terms of that time. Then, use those expressions to relate the 2 distances ($\frac{1}{2}$ mile apart).

(22)

	r rate (mph)	$\times$ t time (hrs)	= distance distance (miles)
Russ	5	$t+\frac{1}{6}$	$5(t+\frac{1}{6})$
Janet	7	t	$7t$

let t = time elapsed
*remember 10 min = $\frac{1}{6}$ hr

This time the distance travelled will be the same when they meet. We can express distance in terms of time (t) and equate those distances.

Russ' distance = Janet's distance

$$5(t+\tfrac{1}{6}) = 7t$$

$$5t + \frac{5}{6} = 7t$$

$$\frac{5}{6} = 2t$$

$$\frac{5}{12} = t$$

$$\frac{5}{12} \text{ hr} = 25 \text{ min}$$

Russ will catch Janet in 25 min.

(23) $r \times t$ = Part completed

	Rate Pollutant per hour	Time (hours)	Part of Job accomplished (pollutant)
Pollutant from A	$\frac{1}{x}$	26 hr	$\frac{26}{x}$
Pollutant from B	$\frac{1}{2x}$	26 hr	$\frac{26}{2x} = \frac{13}{x}$

If it took you 3 hours to do a job, you would be working at a rate of $\frac{1}{3}$ / hr. ∴ we can express rate as $\frac{1}{x}$ / hr.

let x = # hours it takes company A to produce the max Amt of pollutant

Company A's part of Job + Company B's part of Job = Whole Job

$$x\left(\frac{26}{x} + \frac{13}{x} = 1\right)$$

$$26 + 13 = x$$

$$39 = x$$

B's rate $= \frac{1}{2x} = \frac{1}{2(39)} = \frac{1}{78}$

Plant B does $\frac{1}{78}$ of job per hour. Therefore, it would take 78 hours to complete the whole job.

---

(24)

	rate (amt/hr)	time (hr)	Part of Job
Pipe 1	$\frac{1}{10}$	$x+5$	$\frac{1}{10}(x+5)$
Pipe 2	$\frac{1}{12}$	x	$\frac{x}{12}$

$\frac{1}{10}$ of Job finished in 1 hr.

Note: Do not confuse the rate for the amount of time it takes for the two pipes to complete the Job. Also the first pipe is open for 5 extra hours.

let x = elapsed time.

Pipe 1's part of Job + Pipe 2's part of Job = Whole Job

$$60\left[\frac{1}{10}(x+5) + \frac{x}{12} = 1\right]$$

$$6(x+5) + 5x = 60$$

$$6x + 30 + 5x = 60$$

$$11x = 30$$

$$x = \frac{30}{11}$$

$\boxed{\text{It takes } 2\frac{8}{11} \text{ hours to fill the pond}}$

(25)

	Rate (part/hr)	time (hours)	Part of Job $r \cdot t$
Inlet	$\frac{1}{5}$	x	$\frac{x}{5}$
outlet	$\frac{1}{8}$	x	$\frac{x}{8}$

Note Having the outlet pipe open is like leaving the drain open when you fill a tub. Eventually it will fill up, but you will be losing water as you go.

let x = time needed to fill pool

Amt added by Inlet pipe − Amt lost by outlet = whole

$$\left[\frac{x}{5} - \frac{x}{8} = 1\right]40$$

$$8x - 5x = 40$$

$$3x = 40$$

$$x = \frac{40}{3} \quad \text{or } \frac{40}{3}\text{ hr}$$

It takes $13\frac{1}{3}$ hours to fill the Pool.

---

(26) In this problem, the pool is filling at a rate of $\frac{1}{\frac{40}{3}}$ or $\frac{3}{40}$/hr for 1 hour. The rest of the time, it is filling at $\frac{1}{5}$/hr.

	Rate part/hr	time (hrs)	Part completed
1st hour	$\frac{3}{40}$	1	$3/40$
remaining hours	$\frac{1}{5}$	x	$\frac{1}{5}x$

let x = the amt of time needed to fill pool once mistake is discovered.

Part completed in first hr + other part = whole Job

$$40\left[\frac{3}{40} + \frac{1}{5}x = 1\right]$$

$$3 + 8x = 40$$

$$8x = 37$$

$$x = \frac{37}{8}$$

It takes $4\frac{5}{8}$ hrs to fill Pool.